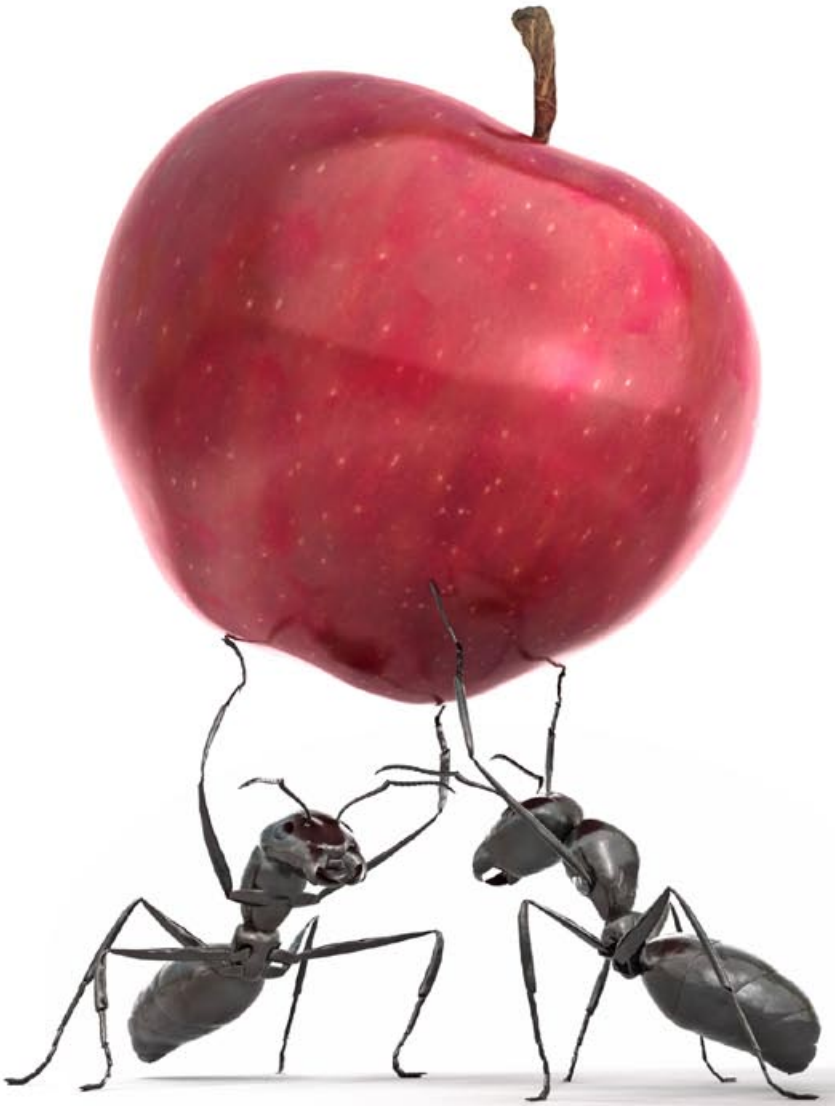
SLU

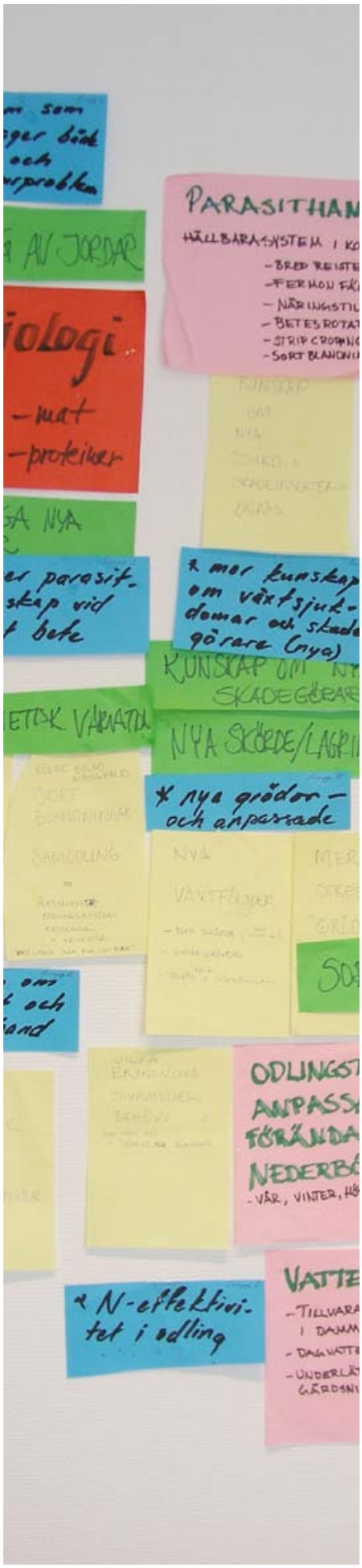
Framework Programme for Research

on Organic Production and Consumption 2010–2012



Centre for sustainable agriculture CUL

ISBN:978-91-86197-72-8
Layout & editing: Karin Ullvén, CUL
Photos: page 1 and 16-17: Karin Ullvén, other: ©iStockphoto.com
Printed at Fyris-Tryck AB
Year: 2010.



Preface

The interest in organic products on the market and among consumers has considerably increased since the last framework programme was written (Organic Agriculture – Production and Consumption. Framework Programme for Research 2007–2009; CUL, 2007). Meanwhile, the debate on the scientific evidences for the benefits of organic production on the environment, health and animal welfare has escalated in society and in the scientific community. Thus, there is a great need for research on organic production and consumption within the next few years. This framework programme is a description of the requirements for new knowledge.

The Framework Programme aims to guide and inspire researchers who are interested in organic production and consumption. It will also serve as decision support for research funding agencies when announcing grants in the area, as well as assisting them in prioritising among project applications.

The Framework Programme was compiled by the Centre for sustainable agriculture (CUL) at the Swedish University of Agricultural Sciences, in collaboration with stakeholders in the food chain, researchers and research funding agencies through the National Consultation Committee for Research Initiation and Monitoring in Organic Production and Consumption, ('the Consultation Committee'). See next page for member organisations of the Consultation Committee in 2009, when this Framework Programme was developed. CUL has been responsible for the development of framework programmes for research on organic agriculture since 2000, and this is the fourth in succession.

Four focus areas

At an early stage, the Consultation Committee selected four key areas on which to focus: Climate, Energy, Sustainable Food Systems and The Market. These areas are expected to constitute central parts of the discussion on sustainable development in coming years and will require research on organic food production and consumption. The areas are deliberately broad to accommodate research questions that cover various parts of the production chain.

Broad process with regional workshops

The Framework Programme was developed through a broad process in which all interested parties were given the opportunity to influence and participate. The role of CUL was to lead and coordinate the work. Sara Antell and Karin Svanäng, both employees at CUL, were responsible for the practical work of preparing the programme. They were assisted in this task by a working party consisting of employees at CUL (Johanna Bjorklund, Susanne Johansson, Rebecka Milestad, Charlotte Lagerberg Fogelberg and Torbjörn Rydberg) and representatives from LRF

(Kjell Ivarsson and Isabel Moretti), the Organic Farmers' Association (Inger Källander), the Swedish Board of Agriculture (Ann-Marie Dock Gustavsson) and the Swedish Dairy Association (Christian Swensson). The Consultation Committee also assisted in the process. A central part of the work consisted of three regional workshops, which took place in 2009:

- October 7 at SLU in Alnarp, in collaboration with the Partnership Alnarp, on the theme 'Climate'
- October 20 at SLU in Skara, in collaboration with AgroVäst, on the theme 'Energy'
- October 27 at SLU in Umeå, in collaboration with the Department of Agricultural Research Northern Sweden, on the themes of 'Sustainable Food Systems' and 'The Market'.

In total, nearly 100 people, including scientists, representatives from various agricultural organisations and authorities, farmers and other entrepreneurs attended these workshops.

The workshops started with inspirational lectures and then moved into structured group discussions in which opportunities and challenges for organic farming in the future were discussed and research questions formulated. The workshops ended with a joint discussion and further aggregation and prioritisation of the issues that arose. The lectures were filmed and notes were taken from the discussions. The PowerPoint presentations of the speakers and all documentation from these workshops can be found on the CUL website: www.cul.slu.se (CUL, 2009a-c), together with links for providing comments and suggestions.

Consultation process

Based on the material collected in the workshops and other inputs, a first draft of the framework programme was produced and circulated for consultation to relevant authorities, research institutes and food companies. The draft was placed on the CUL website and a link to this page was sent to those who had participated in the workshops and to researchers and graduate students involved in research in organic production and consumption. This public consultation period ran from 12 Dec 2009 to 22 Jan 2010.

The final Framework Programme took full account of the responses received in the consultation process. It also considered the research strategy recently developed within the European research platform for organic production and consumption 'TP Organics' (Schmid et al., 2009). The research priorities of the four focus areas of the Framework Programme thus took account of issues considered urgent at the European level. ■

Uppsala, March 17, 2010

Susanne Johansson, Acting Director, CUL

Members of the Consultation Committee

Members of the National Consultation Committee for Research Initiation and Monitoring in Organic Production and Consumption, ('the Consultation Committee') 2009:

- Centre for sustainable agriculture (CUL), SLU (convener)
- Swedish Ecological Farmers Association
- Ekokött
- Ekologiskt Marknadscentrum
- Formas, The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning
- Gröna näringens riksorganisation (GRO)
- Swedish Board of Agriculture
- Federation of Swedish Farmers
- National Food Administration
- Swedish Environmental Protection Agency
- SLU EkoForsk
- National Veterinary Institute
- Swedish Farmers' Foundation for Agricultural Research
- Svensk Dagligvaruhandel
- Swedish Dairy Association

Contents

Summary

This framework programme was compiled by the Centre for Sustainable Agriculture (CUL) at SLU in cooperation with the National Consultation Committee for Research Initiation and Monitoring in Organic Production and Consumption ('the Consultation Committee').

Complex challenges

The future challenges are complex, and sustainable development of organic production and consumption is closely linked to other sustainability issues in society. The Framework Programme has four focus areas: Climate, Energy, Sustainable Food Systems and The Market, and a final chapter dealing with Cooperation, Communication and Assessment Methods.

Climate impact from organic food systems

In order to reduce the climate impact, research is necessary on how plant nutrient management can be improved. Important questions relate to how nitrogen utilisation can be enhanced, for example through better methods for soil cultivation, fertilisation strategies, crop rotations and animal feeding. Another key issue for organic production is how organic matter from the rest of society can be utilised and the types of systems required to achieve tight, closed recycling loops, and how this can contribute to more appropriate organic fertilisers. Organic agriculture must find solutions that are integrated with food and energy production. In order to reduce the amount of nitrogen in circulation, greater synergy must be achieved between livestock farming and arable farms, as well as better recycling between city and countryside.

The potential to mitigate climate change by storing carbon in the soil is large, but more knowledge is needed on soil processes and how to design the entire farming system in order to best promote the build-up of humus and reduce the need for soil cultivation. Permanent pastures and long-lying leys could play a major role. Since different climate measures can counteract each other or undermine other priority targets, these measures should be the object of advanced studies.

Adaptation to climate change

A changing climate with increased temperatures will shift crop boundaries further north. This will create opportunities to grow new crops and the growing and grazing seasons can be prolonged. However, a warmer and more humid climate also brings the risk of an increase in diseases, pests and weeds. This may be particularly problematic for organic farming, where chemical pesticides are not allowed and where the use of veterinary drugs is restricted. Hardier crops with characteristics that can better cope with stress in the form of drought, frost and winter dormancy will be needed, as well as better plant protection measures.

Increased incidence of extreme weather events will generate a need for knowledge of techniques for harvesting, drying and storing crops, as well as for irrigation and land drainage. Knowledge is also needed on measures to improve soil structure, thereby preventing soil erosion and nutrient losses. For organic production systems, it is particularly important to highlight the various measures that may conflict with each other.

Alternative energy sources

Agriculture and other sectors in society need to replace fossil fuel energy carriers with alternative, non fossil-based energy forms. The energy-saving measures and energy sources that are particularly important in organic production and the systems that are most cost-effective need to be investigated. Existing knowledge among the various actors needs to be safeguarded to achieve more efficient and sustainable systems.

Sustainable organic agriculture

Sustainable organic agriculture requires more effective local management of resources and a higher level of maintenance and use of ecosystem services. This requires more knowledge of the relationships between ecosystem services and biodiversity. More knowledge on the effects of increased intensification is also needed. Building resilient systems, for example by maintaining a high genetic diversity in terms of varieties and breeds and a rich diversity of farmland, will be crucial to withstand climate change.

Animal health and welfare in terms of herd size, the suitability of existing breeds and the design of the regulatory framework should be further explored. Increasing the sustainability of farming requires that the animals are healthy and that their species-specific characteristics are exploited to a greater extent, for example foraging behaviour and the ability to digest foodstuffs that do not compete with human needs. In order to reduce the global demand for agricultural land, research is needed to enable local production of feed, as well as feed based on by-products from other parts of the food chain and from production of biofuels. Factors that positively or negatively affect the possibilities for collaboration between livestock farms and arable farms need to be analysed, as well as interactions with the rest of society.

There is also a need for more research on the overall impact of different foods on the environment, working conditions and other socio-economic effects. Ways in which agriculture can be moved in a more multi-functional direction to create a positive impact on rural development must be identified.

Market requirements

Knowledge of the market and how to develop partnerships are important research questions. More and more people are demanding organic products and the organic fruit and vegetable cultivation in particular needs

to be developed to meet a growing demand that today is largely met by imports. More knowledge is needed about how to resolve bottlenecks in the food chain and develop more effective solutions in regional logistics and processing. Important factors in the transition of organic production from niche to volume need to be studied, as well as how organic farming can be carried out more efficiently without losing values such as traceability and animal welfare. It is also important to examine how the individual producer is affected by a change in production scale.

The question of why consumers choose organic products is interesting. Opportunities to build values such as animal welfare, health and biodiversity into organic products must be identified. It is also important to examine how payment for added values can be distributed more equitably among producers and downstream in the food chain. More knowledge is also needed on how different production systems and procedures for processing and storage affect food quality, nutrient content and content of other healthy substances, as well as how infectious agents and concentrations of toxic substances can be avoided. The link between various aspects of food quality and health needs further investigation.

Collaboration and methodology

Collaboration and international partnerships remain important in achieving strong research in organic production and consumption. Communicating research results and effectively putting these into practice requires broad participatory and process-orientated approaches. Evaluation of sustainability requires methods for analysing entire food systems, with all their components. Further development of methods to compare the resource utilisation, quality and synergy of different systems is urgently needed for the future. The development of interdisciplinary analysis and methods, as well as participation approaches, is central to research in organic production and consumption. ■

Introduction

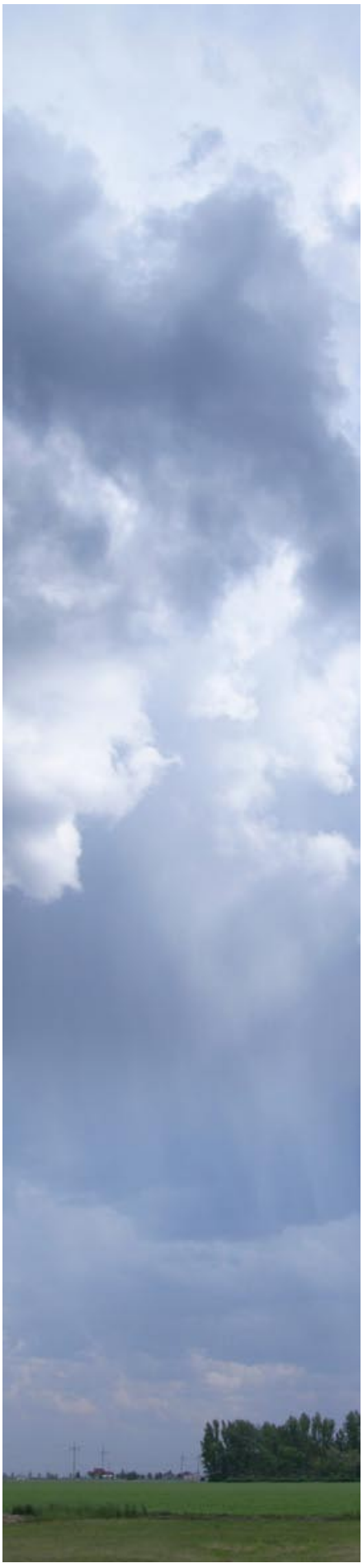
Production and consumption of food have a major impact on many ecosystem functions that are crucially important for humanity and on the climate (MA, 2005; IPCC, 2007). If we do not respect the planet's biophysical limits, there is a danger that by affecting a number of important global processes, we will bring about environmental changes that are irreversible and that have consequences for our survival (Rockström et al., 2009). At the same time, the growing world population is placing additional pressure on food systems, which is contributing to increasing pressure on finite resources of fossil energy and basic cultivation resources such as land and fresh water (Steinfeld et al., 2006; FAO, 2008). In order to sustainably manage these complex problems, there will be extensive demands for fundamental changes not only in agriculture, but also throughout society. In a global perspective, research is necessary on how organic farming can contribute to world food security with lower use of finite resources and inputs with less environmental impact.

Organic food systems face the same basic problems as other systems for the production and consumption of food. However, there are additional questions for organic farming to face in the future. The concept behind organic farming is to develop sustainable food systems. As guidelines, there are certain principles concerning health, ecology, fairness and welfare (IFOAM, 2009). Certified organic production complies with EU law in this area (Commission Regulation No. 889/2008 and 834/2007), with the possibility of additional national supplements (KRAV, 2009). In Sweden organic production contributes to the achievement of important goals for society, for example, the National Environmental Quality Objectives (Nilsson, 2007). Against this background, the Swedish Government has formulated specific targets for the expansion of organic food production and consumption (Regeringen, 2006).

Four interdisciplinary areas were selected for particular attention in this Framework Programme: *Climate, Energy, Sustainable Food Systems* and *The Market*. These areas are expected to be central in the discussion on sustainable development in coming years. In order to clarify the multifaceted nature of problems along the food chain and the close links between many issues and developments in the rest of society, a final chapter examines the importance of collaboration and communication and the development of interdisciplinary methods and approaches.

Issues relating to several of the focus areas have been placed in the area considered most relevant. The importance of plant nutrient management and recycling is therefore investigated in the *Climate* section, while biodiversity, ecosystem services and genetic diversity as well as consumer affairs and animal welfare issues can be found under *Sustainable Food Systems*. Issues relating to the joint regulations in the EU, how well they meet the goals of organic production and consumption and the impact of regulations are considered in the section on *The Market*, where issues of quality and health are also included. ■

Climate

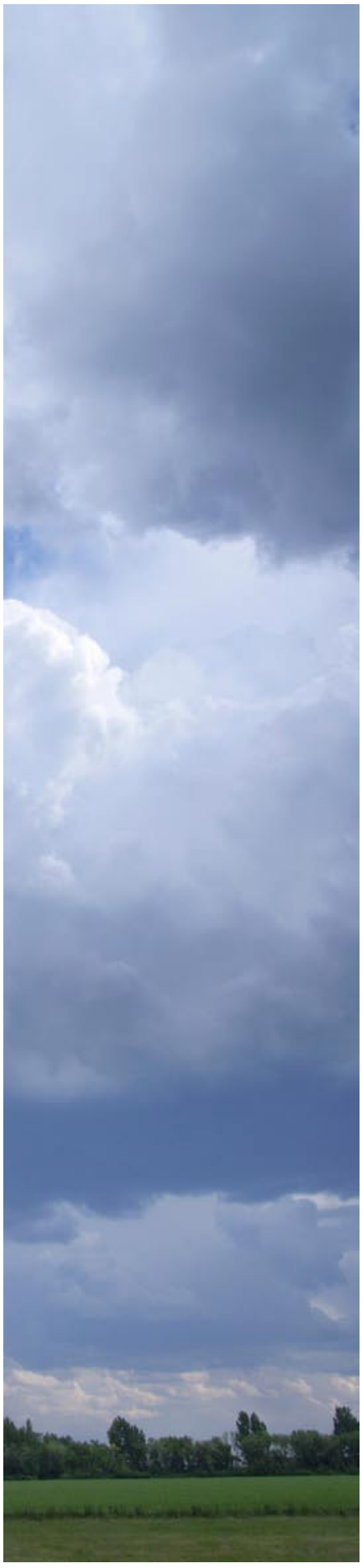


Agriculture affects climate mainly by emissions of the greenhouse gases nitrous oxide, methane and carbon dioxide. In Sweden, agriculture accounts for 70 % of nitrous oxide emissions and 60 % of methane emissions (Berglund et al., 2009). The nitrous oxide mainly comes from nitrogen metabolism in soil, which is influenced by the use of manure and fertiliser and the cultivation of nitrogen-fixing crops (Naturvårdsverket, 2009). Most of the methane is lost from the digestive system of ruminants. However, ruminants also play a key role in organic farming in converting forage, produced from the important ley break crops, into high quality food (Källander, 2005). Agriculture affects carbon dioxide emissions through land use, especially cultivation of organic soils, where aerated organic matter is broken down so that nitrogen is released and large nitrous oxide emissions occur. Meanwhile, agriculture is itself a victim of climate change. In Sweden, the predicted higher temperatures, increased precipitation, changes in precipitation patterns and more erratic weather conditions will pose new challenges for food production.

Ways to mitigate the climate impact of agriculture

Agricultural land can also store carbon dioxide in the soil and thus help to reduce the amount of greenhouse gases in the atmosphere. Agriculture as a whole has great potential to increase such carbon sequestration and reduce greenhouse gas emissions. Factors contributing to increased carbon storage are biomass production, incorporation of organic material, intact soil coverage and high biodiversity (Lal, 2004; Steinbeiss et al., 2008). Similarly, soil physical, chemical and biological properties have a large impact on carbon sequestration capacity. European studies show that the carbon stocks held in permanent pasture can counterbalance the climate impact from cattle grazing on the land (Soussana et al., 2007). Organic farming systems have many similarities to conventional systems, but there are also distinct differences. In general, organic farms have a higher proportion of leys, lower crop yields and slightly more soil cultivation than conventional farms. An important research task is to design these systems to maximise carbon storage. In organic farming, forms of agroforestry and permaculture, as well as permanent pastures and long-lying leys, can play a particularly important role. Increased inputs, such as nitrogen fertilisation and irrigation, may lead to increased risks of nitrous oxide emissions or other counterproductive effects (Schlesinger, 2000).

In order to reduce the carbon footprint from livestock products, it is important that the animals are healthy and have high production levels and high feed efficiency (Lundström et al., 2009). Greenhouse gas emissions from Swedish farming have declined in recent years. Some of this emissions reduction can be explained by a decrease in the



number of farm animals, but the main reason is probably improvements in production efficiency, leading to lower emissions per kg product (Cederberg et al., 2009b). However, meat consumption in Sweden rose sharply in recent years, mainly covered by imports, which has led to our overall global climate load becoming larger (Cederberg et al., 2009a). This clearly illustrates the importance of including the entire food chain when different environmental impacts are assessed.

Improved recycling and increased efficiency

Manure produces emissions of methane and nitrous oxide, and from the climate point of view manure management and the development of biogas plants are important. More partnerships at local and regional level between farms, especially arable farms and livestock farms, would enhance the effectiveness of the nitrogen in circulation (Wivstad et al., 2009). Plant nutrition management must be improved not only at farm level, but also throughout the food system, for example through biogas production and recycling of urban waste. This in turn may lead to other positive effects on the aquatic environment, soil fertility, pest control and elimination of weed seeds (Jensen, 2009). Key issues in organic production are therefore to support diversification activities and promote opportunities to take advantage of organic wastes from society.

Adaptation to climate change necessary

Climate change will affect already vulnerable areas of the world most severely. However, conditions in Sweden will also change and the conditions for agriculture will in many cases be more difficult (IPCC, 2007; Jordbruksverket, 2007). Increased temperature will shift growing boundaries northward, creating opportunities for other crops and extension of cultivation and grazing seasons (Fogelfors et al., 2008). At the same time, it is predicted that the spring and autumn will become wetter while the growing season in July will be drier. There is a risk of an increase in diseases, pests and weeds, which will be particularly severe for organic farming where chemical pesticides are not allowed and where the use of veterinary drugs is restricted. Hardier crops with characteristics that cope better with stress in the form of drought, frost and lack of winter acclimatisation will be needed, as well as better crop protection measures, including preventive methods such as properly balanced crop rotations and more direct approaches such as mechanical weed control. More common incidences of extreme weather events will require knowledge of techniques for crop harvesting, drying and storage, as well as irrigation and land drainage. The resilience of cultivation systems needs to be increased and measures to improve soil structure, thereby preventing soil erosion and nutrient losses, need to be developed. For organic production systems, it is important to examine how future climate change will affect different parts of the system and whether different measures such as soil cultivation and energy use conflict with each other. A particular fear is that the incidence of va-

rious vector insects and ticks may increase, thereby increasing the risk of formerly rare diseases, many of which are zoonoses, i.e. affect both humans and animals. Summers with longer periods of heat and higher temperatures, especially in southern Sweden, will increase the risk of heat stress among farm animals. This will place greater demands on the design of buildings and outdoor areas (Lundström et al., 2009).

Research targets

- To increase nitrogen use efficiency in organic crops and improve soil cultivation practices, fertilisation and crop rotation strategies in order to minimise erosion and nutrient leaching.
- To improve our understanding of how soil processes affect carbon storage and soil structure and how this is related to site-specific conditions such as soil type and cultivation history, as well as how production systems are organised, for example no-till farming and pasture-based meat production.
- To improve our knowledge of animal nutrition, especially that of monogastric animals, so that the requirements for essential amino acids are met without overfeeding protein.
- To identify the changes necessary for a greater proportion of plant nutrients from food consumption to be returned to agriculture in a hygienic and environmentally safe manner.
- To develop systems for tight local loops, and to contribute to better handling, storage and distribution of organic fertilisers.
- To develop the information required so that different climate measures do not undermine or counteract other priority targets, and to analyse and assess the impact of emissions using various authoritative methods.
- To develop strategies for free-range animal husbandry and farm building design for organic production in a changing climate and action plans to handle the spread of infection, disease and parasites.
- To develop the knowledge needed for organic farming to be able to adapt to increasingly extreme weather conditions through changes in cultivation, weed control and harvesting techniques, procedures for drying and storage, as well as design of irrigation and land drainage.
- To help provide organic farmers with access to more resistant crops and varieties that can withstand wide variations in rainfall and temperature and thus ensure high and consistent production of high quality.
- To determine how measures to mitigate climate impacts by increasing carbon storage, for example through high yields, relate to actions that cause greenhouse gas emissions, for example by increasing the use of different inputs. ■

Energy

Fossil energy systems of today are not aligned in global circulation and have negative environmental impacts. The point where the rising oil production begins to decline, (Peak Oil), which can cause large price increases, is imminent (Helmfrid & Haden, 2006). Increased costs for energy-intensive inputs in agricultural production, combined with increased demand for crops, have contributed to large price fluctuations in food and increased concern for future food security (FAO, 2009).

Resilient systems with low external inputs

In the near future, fossil fuel energy will be even more limited than today, which places great demands on all of society. The phasing out of fossil fuels will require a reduction in fossil energy use through the use of more efficient energy systems and new energy sources (Regeringen, 2009). However, it is increasingly clear that the fossil-free option must be more robust than today. Future energy systems must be increasingly based on renewable resources and recycling, as well as being adapted to local conditions. Therefore there is a need for future investment in a variety of methods and techniques, not just those currently considered to be the most profitable. Energy conversion should not impede the national environmental quality objectives.

Organic farming in the conversion to fossil-free systems

Agriculture faces the multiple challenges of replacing fossil energy with new, non fossil-based energy sources, increasing global food production and promoting carbon storage in soils and vegetation. Organic farming, like the rest of agriculture, relies heavily on the direct use of energy, but the major difference lies in its lower use of indirect use of energy in the form of fertilisers, pesticides and feed purchased (Jørgensen et al., 2005). However, in order to achieve greater self-sufficiency, organic farming needs more efficient utilisation of natural resources and processes, i.e. needs to become more ecologically adapted. This includes greater diversity of plants and animals, measures to increase soil fertility, recycling of nutrients and reduced tillage and higher utilisation of local resources and natural processes. All these measures in turn can increase efficiency (Niggli et al., 2009, Schmid et al., 2009; Wallgren & Höjer, 2009). A particular challenge for organic agriculture is to maintain high food production levels and increase its ability to cope with external strains, while at the same time converting to, and increasing the production of, new non fossil-based energy sources. Development of energy production at the local level is a key element in the pursuit of self-sufficiency and energy efficiency. However, it is not sufficient to simply improve energy efficiency at farm level. Since 80 % of the energy consumed in the food chain occurs downstream of primary

production, research must move its focus from primary production to all parts of the food chain (Wallgren & Höjer, 2009). Efficiency must be increased throughout the food chain in order to optimise the use of resources and avoid unnecessary waste.

Research targets

- To identify energy-saving measures and alternative energy sources that are especially important in organic production and the most cost-effective systems.
- To ensure rapid introduction of practical and energy-saving measures, such as more efficient engines, solar cells and biogas plants.
- In a longer term perspective, to guide the transition to a fossil-free society with more radical changes which can increase the share of renewable resources, recycling and adaptation to local conditions.
- To synthesise existing knowledge and create new knowledge about how to build multi-functional systems and the indirect energy saving methods that can evolve and contribute to higher efficiency.
- To develop solutions for transport and logistics in food systems, in which issues related to animal and disease control are also considered. ■

Sustainable Food Systems

Our food systems consist of primary production, processing, transport and distribution, consumption, waste management and recycling of nutrients to farmland. In addition to food, agriculture produces other goods and services. Multifunctional agriculture is important for rural development and for sustainable development in the rest of the society.

More ecologically adapted food systems

Organic farming needs to have more effective local resource management. This requires, among other things, a larger element of recycling, as well as knowledge on how fossil fuel-based inputs can be replaced by local ecosystem services. There are currently significant gaps in knowledge. What is the relationship between biodiversity and ecosystem services? What is the role of individual species, composition of biological communities and diversity for important ecosystem functions? It will probably be increasingly important to maintain a high genetic diversity, both farmed and wild, but also a wide variation in farmland as an insurance against changing environmental conditions, especially in the wake of climate change.

For organic agriculture to be developed in a way that exploits its potential to promote biodiversity, a deeper understanding is needed of how agriculture affects biodiversity, and how diversity is affected by factors such as landscape composition and the scale of the production systems.

Increased collaboration between pure arable farms and livestock farms is a structural change that would increase sustainability and provide beneficial effects such as reduced dependence on purchased inputs, more diverse crop rotations, more efficient use of fertiliser, improved soil structure, open land and reduced transportation. The importance of horticulture for food security and its ability to integrate and exploit the local loop, as well as hosting various ecosystem services, should not be underestimated. In the move towards a more sustainable society increasingly based on local resources, leisure farming, small-scale animal husbandry, peri-urban farming and various forms of shared farming and ecotourism can become increasingly important.

The welfare of farm animals need to be considered and their characteristics fully utilised

Having thriving and healthy animals is fundamental to sustainable production. Since animal welfare is among the greatest value added in organic agriculture, it should dominate research in this area. Poor health and high disease pressure in herds reduce productivity, shorten the life of animals and increase the need for replacement animals. This leads to increased emissions and increased use of resources. Previous studies have shown that animal health in organic herds, with the exception

of parasitic diseases, is as good as, or better than, that in conventional systems (Lund & Algers, 2003; Fall, 2009). However, there are indications that the situation has deteriorated to some extent, for example for organic pigs (Heldmer, 2009).

Livestock production and the consumption of meat, milk and eggs account for a large proportion of the resource utilisation and environmental impact of food systems (Steinfeld et al., 2006; Lundström et al., 2009). By taking more advantage of species-specific characteristics and allowing them to act as positive aspects of farming systems, livestock production can become more sustainable. This can involve better use of animal foraging behaviour and their ability to digest food that does not compete with human needs, or to bring about increased cooperation between neighbouring farms for optimal use of resources. Despite far-reaching goals that organic animals should be fed using materials produced as locally as possible, imports of feed concentrates have increased in recent years and are likely to increase further (Ekologiska Lantbrukarna, 2009). This is due to the fact that the number of animals in organic production has increased (mainly dairy cows and laying hens), but also to the requirement for 100 % organic feed, which further reinforces the lack of domestic concentrates. Although this may be a passing phase, the trend should be taken seriously and increased efforts devoted to the development of local feed resources, and better utilisation of indigenous by-products from other parts of the food chain and bioenergy production.

Consumption from a diversity perspective

In order to secure future food security, there is a need for both small- and large-scale food systems to evolve. The actors in the small-scale systems should primarily develop collaborations and logistic resources to increase their competitiveness and to address problems with seasonal, small quantities, uneven flow and major transportation needs. The vulnerability of the larger-scale systems is that there are often many links in the food chain and that knowledge of how a product is produced, processed and transported is low among consumers (Lamine, 2005). In the drive towards more sustainable food consumption, consumers have the capability (and responsibility) to guide developments in the right direction by demanding sustainably produced food. In order to make informed choices, consumers must have access to relevant information about the impact of different foods on the environment, working conditions and other socio-economic factors. Consumption also depends on social, cultural and economic dimensions. In order to increase knowledge about the consumption of organic products, a broad research perspective is needed in which elements from all stakeholders in the food chain are included.

Research targets

- To analyse the relationship between biodiversity and ecosystem services and how the various ecosystem services are interconnected.
- To develop knowledge of how farmland can best promote and utilise various life-supporting processes. Such research would also benefit the individual farmer who wants to work successfully with these issues on the farm.
- To examine potential effects of intensification of organic agriculture so that it does not become counter-productive, for example with regard to reliance on ecosystem services.
- To determine how the fundamental principles of organic agriculture, such as naturalness and care, can be exploited without compromising the welfare of the individual animal, disease control and technical innovation.
- To investigate the consequences of increasing herd size and streamlining operations.
- To adapt the animal breeds used today to organic production methods.
- To examine how the regulations on free-range and pasture for all species, longer suckling period, 100% organic feed and home-grown feed affect disease control issues and the increasing demand for rationality and output on livestock farms.
- To identify the conditions for better utilisation of animal foraging behaviour and the ability of some animals to assimilate food that does not compete with human needs, and for the creation of partnerships between farms to allow better resource utilisation.
- To develop animal husbandry systems based more on local production of feed or on by-products from the rest of the food chain or from the production of biofuels, in order to improve nutrient recycling locally and reduce our dependency on the surrounding world and the demand for global land.
- To investigate the conditions and potential for development of small-scale, peri-urban organic farming and horticulture.
- To analyse the multifunctional role of agriculture in sustainable societal development, which affects everything from food and recycling solutions to landscape values and recreation.
- To determine the social, cultural and economic determinants of consumption in relation to organic products. ■

The Market

A functioning market is essential to ensure the supply of organic food and to bring profitability in production. Demand for organic products is rising and in Sweden, consumption is currently higher than production. This means that some organic food that could be produced within Sweden is still being imported (KRAV, 2010). Although sales of organic products have increased, with its ~3 % of market value it is still niche production (the Nielsen Company, 2009).

From niche to high volume

The market for organic food has been expanded in recent years through a number of new products and distribution channels. To increase volume further, consumption in the public sector is important. The Swedish Government has formulated a goal that 25 % of state food procurement should be organic (Regeringen, 2006). Some local governments already have targets for a high percentage of organic, while others have not yet begun to take on the task (Holm & Jansson, 2007). The increased consumption of organic products places new and greater demands on the ecological food chain and may also require changes in procurement and purchasing processes. The increased interest in both small-scale farming and locally produced goods requires, for example, a different type of logistics and local distribution networks. The trend in recent years, with the emergence of extensive small-scale organic production, is likely to continue, in combination with new products, new technology and new packaging in more large-scale systems. The need to solve logistical problems for small and medium-sized enterprises, many of which are organic producers, will therefore continue to be great and solutions on how local products can be transported in a more sustainable manner need to be developed (Ekologiska Lantbrukarna, 2009). The adaptation of primary production to the needs of consumers and society requires processing of organic products. When processing has access to larger quantities and more uniform flow of organic raw food materials, the supply of organic products can also increase.

Added values, quality and health

In recent years, the major grocery chains have been the driving force behind the launch of organic products, e.g. through the development of entire ranges of own brands, although small innovative entrepreneurs have also created new market places. Home delivery by ordering online and local markets where consumers and producers can meet have increased in popularity, although these are still relatively small-scale. As the distance between producer and consumer has declined in many cases, there has been a change in producer-consumer relations, which by extension may affect the development of organic products according to consumer preferences and motivations. Furthermore, consumption

patterns will need to be modified to reduce environmental impacts. Organic food is often associated with value concepts such as 'natural' and 'healthy', where ingredients come directly from the producer and where processing enhances the original properties of the product without 'unnecessary' additives. This is the result of many consumers demanding greater traceability of products, such as raw materials with a defined origin, and more information about production methods (Rasmussen, 2009). The quality of organic produce and its effects on health and welfare need to be further clarified if consumers are to have continuing confidence in such production. For those who are working to produce high quality food, it is therefore important to find successful ways to convert value added into a price premium (Lagerberg Fogelberg, 2008; Liljenstolpe & Elofsson, 2009). Obtaining a premium for organic produce can be a powerful force in getting more farmers to convert to organic production and in getting farms that are already converted to continue with their production. For the farmer and his ability to continue production, the lack of understanding of farming conditions and price pressure from subsequent parts of the chain can be a major problem (Smith & Marsden, 2004; Sundkvist et al., 2005).

Environmental subsidies and regulatory framework

Consumers who buy organic products often want to protect both their own health and the environment. Clear and current information on how the regulations for organic production can affect the properties of the products are relevant to facilitate consumer choices. New findings are continuously affecting the regulatory framework for organic products (Wivstad et al., 2004).

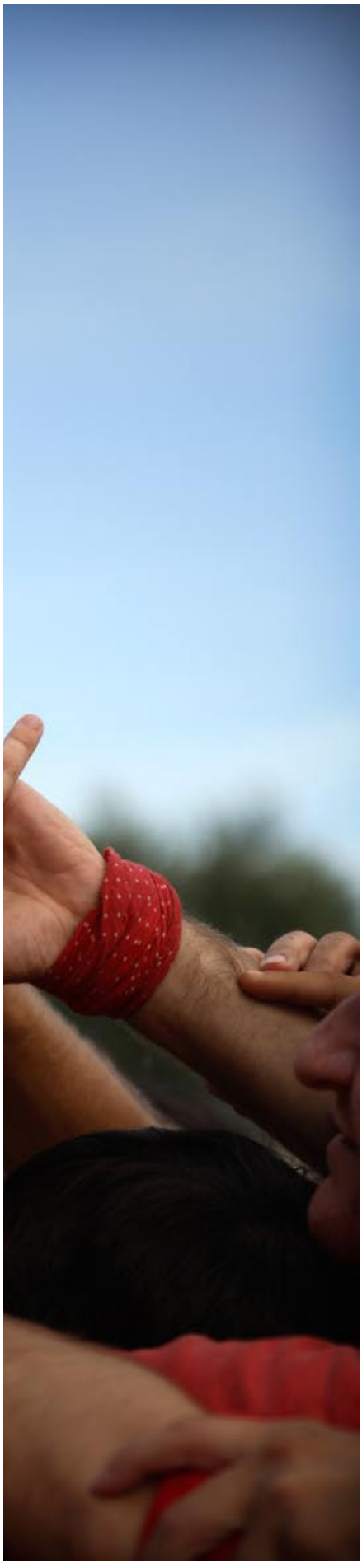
Organic farming is already positive for many of the environmental quality objectives (Nilsson, 2007). Nevertheless, it is important to study how different policy instruments for organic production, such as environmental subsidies, affect producers and, by extension, the environment.

EU regulations govern what can be called organic in the EU. Certification and labelling of products confirm to consumers that production is carried out in accordance with the regulations. Environmental subsidies for organic production were changed in the new Rural Programme for 2007–2013. Environmental subsidies for certified production were raised to encourage more products onto the market (Jordbruksverket, 2009; 2010). Different designs of regulatory and policy instruments need to be analysed to assess their environmental impact.

Research targets

- To create new knowledge on how to coordinate the various components of the organic food chain, the impact this has on the surrounding society, and how coordination could be improved, both for small- and large-scale systems.

- To help expand organic fruit and vegetable cultivation to meet the growing demand, which today is largely met by imports.
- To identify important factors in moving organic production from niche to volume.
- To increase understanding of how individual producers are affected by conversion to higher production volumes and thresholds and opportunities that exist for increasing in scale.
- To develop an understanding of how organic production can be scaled up without losing values such as traceability and various aspects of health.
- To investigate why consumers choose organic products, the quality issues that ultimately affect health, whether organic products are healthier and the health parameters actually requested by consumers.
- To compile current knowledge about consumer attitudes to organic production and consumption and the role of consumers in the market.
- To explore the differences between attitude and behaviour, how different incentives affect behaviour in the market and the price sensitivity of different organic products.
- To better understand how different production systems and procedures for processing and storage affect the nutrient content and other healthy substances in food products and how to avoid infectious agents and concentrations of toxic substances.
- To develop processes, especially for smaller organic producers, that provide the opportunity to compete and act on the market. ■



Collaboration, Communication and Evaluation Methods

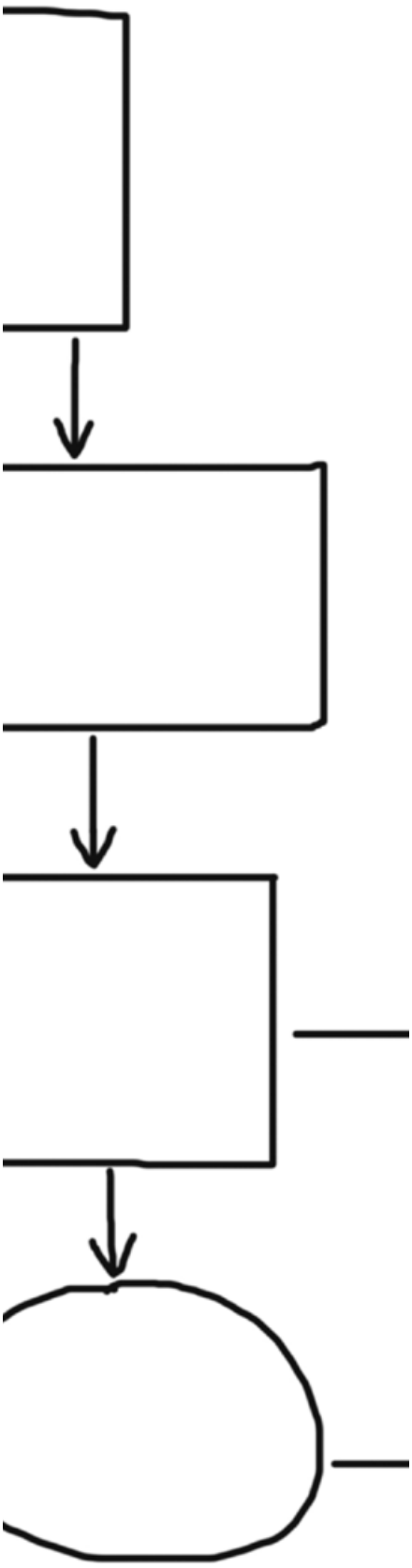
Questions about how organic food systems can evolve to become more sustainable are complex and do often require knowledge spanning many disciplines and subjects. To develop research in this large area and to make the best use of knowledge, in-depth interaction and a greater exchange of knowledge between theory and practice are required. Through cooperation between actors with different perspectives, research resources can be used more optimally and the conditions to solve the problems raised in this framework programme radically improved. In parallel with an increase in national research collaborations, new collaborations should be developed internationally in contact with other researchers, for example through ICROFS in Denmark (www.icrofs.org) or through European collaborations such as the research strategy TP Organics (www.tporganics.eu) and the joint programme CORE Organic (www.coreorganic.org).

For organic production and consumption to become more sustainable, there is an urgent need for research methods that analyse the entire food system and are able to manage all of its component parts. There is also a great need to develop forms of interdisciplinary work. It is important to understand how differences in results produced by different valuation methods and systems analysis can be explained by differences in how researchers defined the systems studied. Depending on fundamental appraisals concerning nature and knowledge, the definition of sustainability, as well as the choice of system boundaries and methodologies to analyse sustainability, can vary (Björklund & Rydberg, 2003). This is too rarely taken into account when research results are interpreted and translated into knowledge. Thus, investments in comparative studies of various analytical tools and methodologies are required, as well as evaluations of the context in which a certain method may be more appropriate.

Interdisciplinary analysis and method development need to be complemented with broad participatory and process-orientated approaches in which various professional groups such as farmers, advisors, researchers and government agencies jointly seek to solve real problems. Within organic farming there is already much experience of these approaches and the sector should continue to lead development in this area. More intensive use of various types of process-orientated research would further facilitate communication between stakeholders and thereby allow faster change towards more sustainable organic production and food systems. Interdisciplinary analysis and method development, as well as participatory and process-orientated approaches, are central to research in organic production and consumption.

Research targets

- To develop constructive international collaborations in which the synergies obtained promote the development of organic production and consumption.
- To initiate collaborations between different universities in order to achieve further synergies and to broaden the perception of organic production and strengthen skills.
- To highlight benefits and obstacles for increased collaboration and interdisciplinary work between researcher and practitioners.
- To develop useful tools and methods that can compare and evaluate aspects such as resource use, quality and synergetic effects of different systems ■



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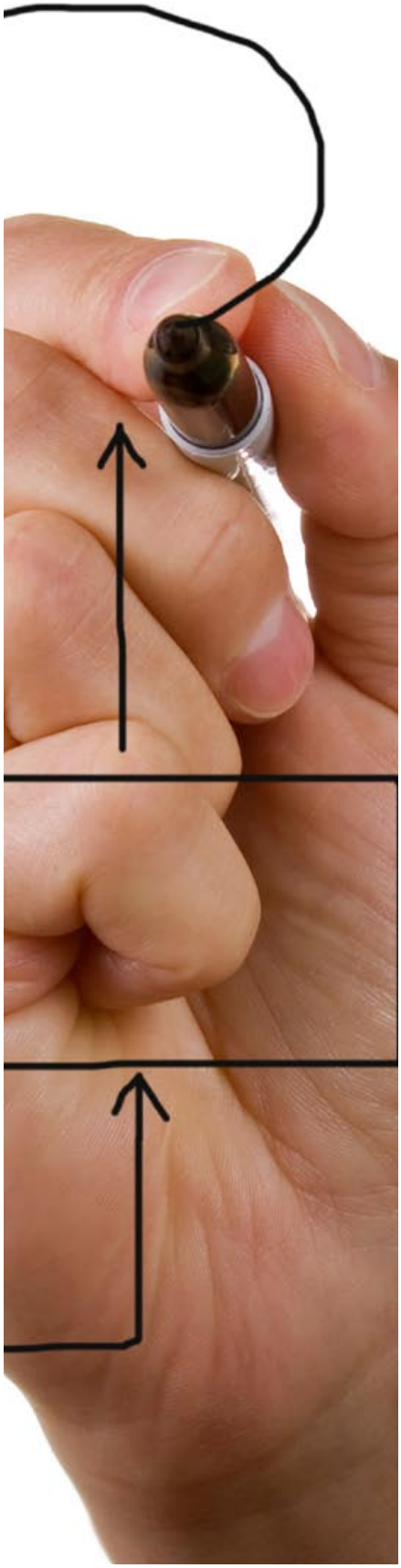

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The Framework Programme for Research on Organic Production and Consumption 2010–2012 aims to guide and inspire researchers who are interested in organic production and consumption. It will also serve as decision support for research funding agencies when announcing grants in the area, as well as assisting them in prioritising among project applications.

The Framework Programme was compiled by the Centre for sustainable agriculture (CUL) at the Swedish University of Agricultural Sciences, in broad collaboration with stakeholders in the food chain, researchers and research funding agencies.

Centre for sustainable agriculture CUL